

## THE CLAIMS

What is claimed is:

- 1           1.     A multiple access communication protocol, comprising:
  - 2                     an uplink channel having a plurality of frames, each frame having a first
  - 3     selectable number of minislots and a second selectable number of slots, a reservation request
  - 4     of a first type being sent into a first selected minislot of a selected frame of the uplink
  - 5     channel when information of a first type is to be sent, the reservation request of the first type
  - 6     requesting an assignment for at least one slot for transmitting information of the first type in
  - 7     at least one frame that is subsequent to the selected frame, a reservation request of a second
  - 8     type being sent into a second selected minislot of the selected frame when the second
  - 9     selected minislot is available in the selected frame and when information of a second type is
  - 10    to be sent, the reservation request of the second type requesting an assignment of at least one
  - 11    slot for transmitting information of the second type in at least one frame that is subsequent to
  - 12    the selected frame, the reservation request of the second type contending for the second
  - 13    selected minislot based on a pseudo-Bayesian Aloha algorithm; and
  - 14                     a downlink channel containing a feedback message having minislot
  - 15    assignment information for sending reservation requests of the first and the second type, slot
  - 16    assignment information for transmitting information of the first and the second type, minislot
  - 17    contention information for the reservation requests of the second type sent in the selected
  - 18    frame, and reservation backlog information for an estimated number of reservation requests

20 occurring prior to an end of the selected frame of the uplink channel.

2. The multiple access communication protocol according to claim 1, wherein the reservation requests of the second type are sent into the second selected minislots, each second selected minislot being selected independently and at random with equal probability from a plurality of minislots available for sending the reservation requests of the second type.

3. The multiple access communication protocol according to claim 2, wherein  
the reservation request message of the second type is sent into the second selected minislot  
with a probability that is based on a number of minislots available in the selected frame for  
sending reservation requests of the second type and on an estimated backlog of messages of  
the second type pending at a beginning of the selected frame.

1           4.       The multiple access communication protocol according to claim 3, wherein  
2       the probability is determined as:

$$p = \min(1, N_R / N_+),$$

wherein  $N_R$  is a number of minislots available for sending reservation requests  
of the second type in the selected frame, and

6                    wherein  $N_+$  is an estimated backlog of reservation requests of the second type  
7   pending at a beginning of the selected frame.

1            5.        The multiple access communication protocol according to claim 1, wherein  
2   the feedback message includes slot assignment information for at least one frame following  
3   the selected frame.

1            6.        The multiple access communication protocol according to claim 1, wherein  
2   the feedback message includes information relating to a number of minislots available in a  
3   frame after the selected frame for sending reservation requests of the second type, and  
4   information relating to an estimated backlog of reservation requests of the second type  
5   pending at a beginning of the frame after the selected frame.

1            7.        The multiple access communication protocol according to claim 1, wherein  
2   the minislot contention information includes information relating to a successful sending of  
3   the reservation requests of the second type.

1            8.        The multiple access communication protocol according to claim 1, wherein  
2   the information of the first type is a talkspurt of a voice message, and the information of the  
3   second type is a data message.

1           9.     The multiple access communication protocol according to claim 1, wherein  
2     the information of the first type is transmitted in the uplink channel in a slot in a frame that is  
3     subsequent to the selected frame that is assigned in response to the reservation request of the  
4     first type.

1           10.    The multiple access communication protocol according to claim 9, wherein an  
2     end indication message is sent in the slot in the frame that is subsequent to the selected frame  
3     that is assigned in response to the reservation request of the first type when transmission of  
4     the information of the talkspurt is ending.

1           11.    The multiple access communication protocol according to claim 10, wherein  
2     the downlink channel contains a message having a minislot assignment in response to the end  
3     indication message.

1           12.    The multiple access communication protocol according to claim 1, wherein  
2     the first selectable number of minislots and the second selectable number of slots are each  
3     predetermined.

1           13.    The multiple access communication protocol according to claim 1, wherein  
2   the first selectable number of minislots and second selectable number of slots are each  
3   adjustable.

1           14.    The multiple access communication protocol according to claim 1, wherein  
2   the uplink and downlink channels are part of a time division multiple access communication  
3   system.

1           15.    The multiple access communication protocol according to claim 1, wherein  
2   the uplink and downlink channels are part of a frequency division multiple access  
3   communication system.

1           16.    The multiple access communication protocol according to claim 1, wherein  
2   the uplink and downlink channels are part of a code division multiple access communication  
3   system.

1           17.    The multiple access communication protocol according to claim 1, wherein  
2   the at least one slot assigned for transmitting information of the first type is assigned based  
3   on a contention-free reservation mechanism.

- 1           18.    A method for providing multiple access to a communication channel, the  
2 method comprising steps of:
- 3                   forming an uplink channel having a plurality of frames, each frame having a  
4 first selectable number of minislots and a second selectable number of slots;
- 5                   receiving a reservation request of a first type contained in a first selected  
6 minislot of a selected frame of the uplink channel when information of a first type is ready to  
7 be sent, the reservation request of the first type requesting an assignment for at least one slot  
8 for transmitting information of the first type in at least one frame that is subsequent to the  
9 selected frame;
- 10                  assigning at least one first slot in response to the received reservation request  
11 of the first type;
- 12                  receiving a reservation request of a second type contained in a second selected  
13 minislot of the selected frame when the second selected minislot is available in the selected  
14 frame and when information of a second type is ready to be sent, the reservation request of  
15 the second type requesting an assignment for at least one slot for transmitting information of  
16 the second type in at least one frame that is subsequent to the selected frame, the reservation  
17 request of the second type contending for the second selected minislot based on a pseudo-  
18 Bayesian Aloha algorithm;
- 19                  broadcasting a feedback message in a downlink channel before an end of the  
20 selected frame, the feedback message containing minislot assignment information for

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21 sending reservation requests of the first and the second type, slot assignment information for  
22 transmitting information of the first and the second type, minislots contention information for  
23 the reservation requests of the second type received in the selected frame, and reservation  
24 backlog information for an estimated number of reservation requests of the second type  
25 pending at a beginning of the selected frame.

1 19. The method according to claim 18, wherein the feedback message includes  
2 slot assignment information for at least one frame following the selected frame.

1 20. The method according to claim 18, wherein the feedback message includes  
2 information relating to a number of minislots available in a frame after the selected frame for  
3 sending reservation requests of the second type, and information relating to an estimated  
4 backlog of reservation requests of the second type pending at a beginning of the frame after  
5 the selected frame.

1 21. The method according to claim 18, wherein the minislots contention  
2 information includes information relating to successful receipt of the reservation requests of  
3 the second type.

1           22.    The method according to claim 18, wherein the information of the first type is  
2   a talkspurt of a voice message, and the information of the second type is a data message.

1           23.    The method according to claim 18, further comprising a step of receiving  
2   information of the first type in the uplink channel in a slot in a frame that is subsequent to the  
3   selected frame that was assigned in response to the reservation request of the second type.

1           24.    The method according to claim 23, further comprising a step of receiving an  
2   end indication message in the slot in a frame that is subsequent to the selected frame that was  
3   assigned in response to the reservation request of the first type when transmission of the  
4   information of the first type is ending.

1           25.    The method according to claim 24, further comprising a step of broadcasting a  
2   message having a minislot assignment in response to the end indication message.

1           26.    The method according to claim 18, wherein the first selectable number of  
2   minislots and the second selectable number of slots are predetermined.

1           27.    The method according to claim 18, wherein the first selectable number of  
2   minislots and the second selectable number of slots are adjustable.



1           28.    The method according to claim 18, wherein the uplink and downlink channels  
2   are part of a time division multiple access communication system.

1           29.    The method according to claim 18, wherein the uplink and downlink channels  
2   are part of a frequency division multiple access communication system.

1           30.    The method according to claim 18, wherein the uplink and downlink channels  
2   are part of a code division multiple access communication system.

1           31.    The method according to claim 18, wherein the at least one slot assigned for  
2   transmitting information of the first type is assigned based on a contention-free reservation  
3   mechanism.

1           32.    A method for providing multiple access to a communication channel, the  
2   method comprising steps of:  
3                sending a reservation request of a first type into a first selected minislot of a  
4   selected frame of an uplink channel when information of a first type is to be sent, the uplink  
5   channel having a plurality of frames, each frame having a first selectable number of minislots  
6   and a second selectable number of slots, the reservation request of the first type requesting an

7 assignment for at least one slot for transmitting information of the first type in at least one  
8 frame that is subsequent to the selected frame,

9 sending a reservation request of a second type into a second selected minislot  
10 of the selected frame when the second selected minislot is available in the selected frame and  
11 when information of a second type is to be sent, the reservation request of the second type  
12 requesting an assignment of at least one slot for transmitting information of the second type  
13 in at least one frame that is subsequent to the selected frame, the reservation request of the  
14 second type contending for the second selected minislot based on a pseudo-Bayesian Aloha  
15 algorithm; and

16 receiving a feedback message from a downlink channel, the feedback message  
17 containing minislot assignment information for sending reservation requests of the first and  
18 the second type, slot assignment information for transmitting information of the first and the  
19 second type, minislot contention information for the reservation requests of the second type  
20 sent in the selected frame, and reservation backlog information for an estimated number of  
21 reservation requests of the second type pending at a beginning of the selected frame, the  
22 feedback message being received prior to an end of the selected frame of the uplink channel.

1 33. The method according to claim 32, wherein the reservation requests of the  
2 second type are sent into the second selected minislots, each second selected minislot being

3 selected independently and at random with equal probability from a plurality of minislots  
4 available for sending the reservation requests of the second type.

1 34. The method according to claim 32, wherein the reservation request message  
2 of the second type is sent into the second selected minislots with a probability that is based on  
3 a number of minislots available in the selected frame for sending reservation requests of the  
4 second type and on an estimated backlog of reservation requests of the second type pending  
5 at a beginning of the selected frame.

1 35. The method according to claim 34, wherein the probability is determined as:

2 
$$p = \min(1, N_R / N_+),$$

3 wherein  $N_R$  is a number of minislots available for sending reservation requests  
4 of the second type in the selected frame, and

5 wherein  $N_+$  is an estimated backlog of messages of the second type pending at  
6 a beginning of the selected frame.

1 36. The method according to claim 34, wherein the feedback message includes  
2 slot assignment information for at least one frame following the selected frame.

1           37.    The method according to claim 34, wherein the feedback message includes  
2   information relating to a number of minislots available in a frame after the selected frame for  
3   sending reservation requests of the second type, and information relating to an estimated  
4   backlog of reservation requests of the second type pending at a beginning of the frame after  
5   the selected frame.

1           38.    The method according to claim 32, wherein the minislot contention  
2   information includes information relating to a successful sending of the reservation requests  
3   of the second type.

1           39.    The method according to claim 32, wherein the information of the first type is  
2   a talkspurt of a voice message, and the information of the second type is a data message.

1           40.    The method according to claim 32, wherein the information of the first type is  
2   transmitted in the uplink channel in a slot in a frame that is subsequent to the selected frame  
3   that is assigned in response to the reservation request of the first type.

1           41.    The method according to claim 40, wherein an end indication message is sent  
2   in the slot in a frame that is subsequent to the selected frame that is assigned in response to

3 the reservation request of the first type when transmission of the information of the talkspurt  
4 is ending.

1 42. The method according to claim 41, further comprising a step of receiving a  
2 message from the downlink channel containing a minislot assignment in response to the end  
3 indication message.

1 43. The method according to claim 32, wherein the first selectable number of  
2 minislots and the second selectable number of slots are each predetermined.

1 44. The method according to claim 32, wherein the first selectable number of  
2 minislots and second selectable number of slots are each adjustable.

1 45. The method according to claim 32, wherein the uplink and downlink channels  
2 are part of a time division multiple access communication system.

1 46. The method according to claim 32, wherein the uplink and downlink channels  
2 are part of a frequency division multiple access communication system.

1           47.    The method according to claim 32, wherein the uplink and downlink channels  
2 are part of a code division multiple access communication system.

1           48.    The method according to claim 32, wherein the at least one slot assigned for  
2 transmitting information of the first type is assigned based on a contention-free reservation  
3 mechanism.

1           49.    A system for providing multiple access to a communication channel, the  
2 system comprising:  
3                   a central station; and  
4                   a plurality of terminal units coupled to the central station through a  
5 communication channel, the communication channel including an uplink channel having a  
6 plurality of frames, each frame having a first selectable number of minislots and a second  
7 selectable number of slots, a first terminal unit sending a reservation request of a first type  
8 into a first selected minislot of a selected frame when the first terminal has information of a  
9 first type to be sent to the central station, the reservation request of the first type requesting  
10 for an assignment of at least one slot for transmitting information of the first type in at least  
11 one frame that is subsequent to the selected frame, and a second terminal unit sending a  
12 reservation request of a second type for a slot assignment into a second selected minislot of  
13 the selected frame when the second minislot is available in the selected frame and when the

14 second terminal has information of a second type to be sent to the central station, the  
15 reservation request of the second type requesting for an assignment of at least one slot for  
16 transmitting information of the second type in at least one frame that is subsequent to the  
17 selected frame, the second terminal unit contending for the second selected minislot based on  
18 a pseudo-Bayesian Aloha algorithm; and

19 the central station receiving the reservation request of the first type when the  
20 reservation request of the first type is sent into the first selected minislot and the reservation  
21 request of the second type when the reservation request of the second type is sent into the  
22 second selected minislot, and broadcasting a feedback message in a downlink channel prior  
23 to the end of the selected frame, the feedback message containing minislot assignment  
24 information for the first and the second terminal unit to send the reservation request of the  
25 first and the second type, slot assignment information for the first and the second terminal  
26 unit to send information of the first and the second type, minislot contention information for  
27 the reservation requests of the second type received by the central station, and reservation  
28 backlog information for an estimated number of reservation requests of the second type  
29 pending at a beginning of the selected frame,

30 the first terminal unit receiving the feedback message and transmitting the  
31 information of the first type based on the slot assignment information for the first terminal  
32 unit, and

1           50.    The system according to claim 49, wherein the reservation requests of the  
2   second type are sent by the second terminal units into the second selected minislots, each  
3   second selected minislot being selected independently and at random with equal probability  
4   from a plurality of minislots available for the second terminal units to send reservation  
5   requests of the second type.

1            52.    The system according to claim 51, wherein the probability is determined as:

2



3                    wherein  $N_R$  is a number of minislots available for sending reservation requests  
4                    of the second type in the selected frame, and  
5                    wherein  $N_+$  is an estimated backlog of reservation requests of the second type  
6                    pending at a beginning of the selected frame.

1            53.    The system according to claim 49, wherein the feedback message includes slot  
2            assignment information for at least one frame following the selected frame.

1            54.    The system according to claim 49, wherein the feedback message includes  
2            information relating to a number of minislots available in a frame after the selected frame for  
3            sending reservation requests of the second type, and information relating to an estimated  
4            backlog of reservation requests of the second type pending at a beginning of the frame after  
5            the selected frame.

1            55.    The system according to claim 49, wherein the minislot contention  
2            information includes information relating to a successful sending of the reservation requests  
3            of the second type.

1            56.    The system according to claim 49, wherein the information of the first type is  
2            a talkspurt of a voice message, and the information of the second type is a data message.

1           57.    The system according to claim 49, wherein the first terminal unit sends the  
2   information of the first type in the uplink channel in at least one slot in at least one frame that  
3   is subsequent to the selected frame that was assigned in response to the reservation request of  
4   the first type.

1           58.    The system according to claim 57, wherein the first terminal unit transmits an  
2   end indication message in a slot in a frame that is subsequent to the selected frame that was  
3   assigned in response to the reservation request of the first type when transmission of the  
4   information of the first type is ending.

1           59.    The system according to claim 58, wherein the central station broadcasts a  
2   message having a minislot assignment in response to the end indication message.

1           60.    The system according to claim 49, wherein the first selectable number of  
2   minislots and the second selectable number of slots are each predetermined.

1           61.    The system according to claim 49, wherein the first selectable number of  
2   minislots and the second selectable number of slots are each adjustable.

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1           62.    The system according to claim 49, wherein the uplink and downlink channels  
2   are part of a time division multiple access communication system.

1           63.    The system according to claim 49, wherein the uplink and downlink channels  
2   are part of a frequency division multiple access communication system.

1           64.    The system according to claim 49, wherein the uplink and downlink channels  
2   are part of a code division multiple access communication system.

1           65.    The system according to claim 49, wherein the at least one slot assigned for  
2   transmission of the information of the first type is assigned based on a contention-free  
3   reservation mechanism.